

2013 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is March 25, 2013. Submit statements to Steve Bagley at sbagley@utah.gov ***

Problem Title: Cold-In-Place Recycling (CIR) Phase IV - Performance Mix Design

No. UT-13.01.11

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Select a Subject Area

☒ Materials/Pavements

☐ Maintenance

☐ Traffic Mgmt/Safety

☐ Geotechnical

☐ Preconstruction

☐ Planning/Asset Mgmt

☐ Transportation Innovation

1. Describe the problem to be addressed.

This is part 4 of a multi-part project. UDOT is in the middle of updating their laboratory design and field testing protocols and controls for Cold-in-place Recycling (CIR) procedures for pavement rehabilitation. Part of the update of these practices includes the development of new end-result performance procedures that can be used in the lab and field to get good materials information in a timely manner to aid in the evaluation of the construction processes and determine proper opening times to traffic. To develop these procedures, evaluation of field data must be collected from upcoming projects to use in getting a better understanding of how the materials react and perform during the construction and placement processes.

2. Describe why this research is important and how it is unique.

The use of CIR to reclaim and rehabilitate pavements has been shown to significantly reduce costs (25% TO 33%) compared to that of using virgin materials. The current versions of these tools utilize a solvent-less emulsion that provides for significantly shorter curing times and earlier opening to traffic. UDOT has fully adopted these pavement rehabilitation practices, however the current procedures used to design, control and evaluate the construction of these materials are time consuming and expensive, and have not been able to prevent some pavement failures due to inadequate timeliness and applicability of test results.

Phases I-III were designed to develop the protocols for sampling and testing of the CIR material using conventional and mix performance testing practices with the goal of creating a series of tests that could be used for mix design purposes. The focus of phase IV is to begin using the procedures identified and developed to define and optimize the blend of emulsion, lime and aggregate, thereby creating a performance based mix design process that can be used for UDOT projects.

The importance of the research lies in the possible loss of very cost-effective rehabilitation practices due to a lack of proper materials control practices and subsequent failures of the processes. CIR has become increasingly important tools for Pavement Management Engineers to use in the rehabilitation of pavements based on continued constrictions in blue-book funding. CIR is a tool that meets purple-book/rehabilitation guidelines.

3. List the research objective(s) to be accomplished:

1. Perform Trial Run of CIR Mix Design Process on one fine and one coarse RAP source
2. Evaluate the impact of lime slurry on the performance of the CIR designs

4. List the major tasks to accomplish the research objective(s):

1. Identify RAP and Emulsion Source
2. Perform Marshall Stability testing for strength on a range of emulsion contents
3. Perform AMPT/Flow Number testing for fatigue on a range of emulsion contents
 - a. AMPT Values could be supplemented with BBR testing on CIR mix
4. Perform SCBB testing for cracking resistance on a range of emulsion contents
5. Identify optimum emulsion content for each gradation
6. Repeat performance testing on optimum blend without lime slurry

5. List the deliverable(s) to come to UDOT from this research study:

1. Proposed CIR mix design process for implementation
2. Proposed Threshold value for acceptance of mix design
3. Recommendation on inclusion of lime slurry in CIR

6. Describe how the results of this study will be implemented at UDOT.

The intent is that the new design process can be used immediately to modify the current CIR specifications for mix design and control, allowing the removal of the current sole-source requirements in the specification. Proposed mix design process would also provide alternative to current mix design process that is patented by industry.

7. Estimated cost - Total: \$50,000

UDOT Share: \$50,000

Other/Matching Funds: \$0

8. Outline the proposed schedule for this study, including estimated start date, duration, and major event dates.

Estimated start date would be as early as July 1, 2013, beginning with a strategy meeting with UDOT. This effort would be expected to take about a month.

Research proposal is based on the use of UDOT AMPT test equipment for modulus and flow number determination.

Materials sampling is dependent upon the schedule of the projects, but would be expected to be initiated and completed this construction season (2013) as mixes will be lab constructed using individually sampled materials from the field. Performance of lab testing is expected to take 6 to 12 weeks, depending on starting date.

Summary of the data and protocols would be expected to take a couple additional months, giving an estimated completion date around January 1, 2014.